

Efficiency Enhancement using Systematic Layout Planning to Reduce the Overall Travelling Cost

Uzair Thakur, Ammar Sayyed, Sarfaraz Mapkar, Belal Ahmad, Afaqahmed M Jamadar
Mechanical Engineering Department
AIKTC-School of Engineering & Technology
Panvel, Maharashtra, India

Abstract— In this paper existing production process layout of Magmachino forge pvt. ltd. are deliberated and a new layout is proposed using systematic layout planning tool in order to permit the quick flow of material, with lowest cost and least amount of travel distance between different workstations. The efficiency of production is depend on how well the available resources such as machines, equipment and employee amenities are located in plant. The different techniques such as flow process charts, activity relationship chart, string diagram has been used. The existing and proposed layouts are compared and the proposed layout shows the cost and travel distance of product/material throughout plant from raw material to packaging are decreased. Thus efficiency of plant is improved thereby reducing overall cost.

Keywords— *Operation process chart, systematic layout planning, activity relationship chart.*

I. INTRODUCTION

Systematic layout planning is the tool used to adjust the desired machines at workplace in such a way that it will minimize material handling throughout different workstations and enhance productivity. Increasing global competition with demand of product is increasing and resources are limited. The industry should produce a product with standard quality which meets customer demand. The impotence to get production process right in workplace leads to delay, excessive inventory, inefficiency, quality of product, high cost etc. hence the need of referring to technique which helps in making right functional plant layout of an organization .The different techniques can be used to improve productivity like TQM , QC, control chart, plant layout etc. Systematic layout planning could be tool to improve productivity in industry by reduction in cost with proper workflow. The research paper presents solving of industrial problem using systematic layout planning in which flow of product (pump impeller) from raw material to dispatch has been studied and existing layout is made. While Designing new plant layout, following entities need to be considered like parts, process, fixed position layout etc. The propose layout is made with help of activity relationship chart. The string diagram is used for measuring the travel distance by product through different workplaces .it has been measured in both existing and proposed layout. The travelling distance and Cost of material handling between workstations is compared in both cases and it has been concluded at the end that efficiency has been improved in proposed layout.

II. LITERATURE SURVEY

Plant layout refers to the physical arrangement of production facilities. It is the configuration of departments, work centre and equipment in the conversion process. The overall objective of plant layout is to design a physical arrangement that meets the required output quality and quantity most economically.[1]The research paper presents solving an industrial problem using the principle of string diagram and simulation software .A string diagram can be used to plot the movements of equipment, material, and essentially when a work study person wants to find out how far the materials travel. A simulation study was under taken to find out the overall efficiency of the plant.[2]

A research paper on production process layout of jute industry where systematic layout planning pattern theory to reduce production cost and increase productivity. The number of equipment and travelling area of material in yarn production have been analyzed. The detailed study of the plant layout such as operation process chart, activity relationship chart and relationship between equipment and area has been investigated.[3]

The paper provided a detailed definition of plant layout and listed efficient labour utilization, manufacturing and maintenance ease, enhanced productivity, manufacturing flexibility, effective utilization of staff, machines , materials , and equipment, as well as reduction of accidents, hazards and inventory handling cost as some of the benefits of well-designed plant layout.[4]

A case study presenting overall picture processes happening in printing industry. The travel time was reduced by relocating machinery. Relocation is based on systematic layout planning.[5]

The paper provided a detailed definition of plant layout; and listed efficient labour utilization, manufacturing and maintenance ease, enhanced productivity, manufacturing flexibility, effective utilization of staff, machines, materials, and equipment, as well as reduction of accidents, hazards, and inventory handling cost as some of the benefits of a well-designed plant layout. The numerous factors that determine the designing of a plant layout were also discussed in full, after which the various types of plant layout were analysedThe paper provided a detailed definition of plant layout; and listed efficient labour utilization, manufacturing and maintenance ease, enhanced productivity, manufacturing flexibility, effective utilization of staff, machines, materials, and equipment, as well as reduction of accidents, hazards, and inventory handling cost

OPERATION	SYMBOL
RAW MATERIAL	
CNC1	
CNC2	
VMC	
CNC1	
CNC2	
BALANCING	
DRILLING	
PACKAGING	
DISPATCHING	

SYMBOL SPECIFICATION



Fig.No.2: Operation flow process chart

IV. ANALYSIS OF EXISTING PLANT LAYOUT

The existing layout of company is shown in Fig.No.3 and present detail of company is discussed :

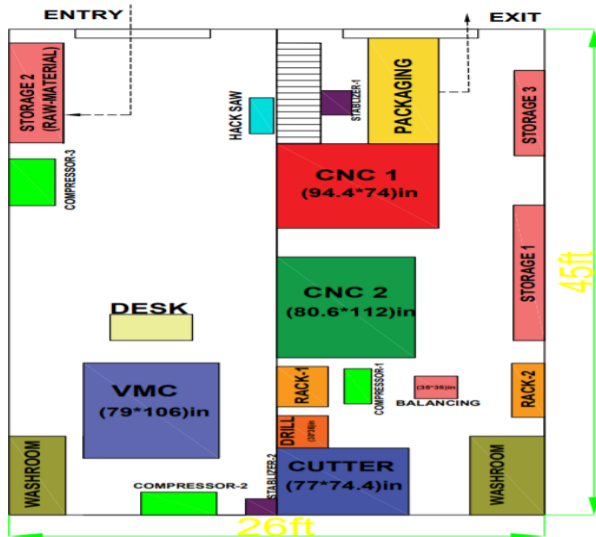


Fig.No.3: Existing layout

The operation process flow is shown in Fig.No.2. According to existing layout the total distance travelled by material and the unit cost and total cost is discussed below. The total cost involved with production is machining cost, raw material cost, transportation cost and wages. The data we obtain from company shows that the transportation cost is 7.33 per feet. Our aim is to rearrange all machines and other resources such a way that total cost and travel distance will be reduced.

TABLE I. DISTANCE AND COST INVOLVED WITH EXISTING LAYOUT

From	To	Distance (ft)	Unit Cost (rs)
raw material	cnc 1	32.1	235.29
cnc 1	cnc 2	2.667	19.54
cnc 2	vmc	75.51	553.48
vmc	cnc 1	65.01	476.52
cnc 1	cnc2	2.667	19.05
cnc 2	static balancing	2.68	19.64
drilling	packaging	4.18	30.63
packaging	dispatch	31.86	233.53
Total		216.674	1587.68

V. ANALYSIS OF PLANT LAYOUT BASED ON ACTIVITY RELATIONSHIP CHART

After study of the manufacturing process, it was found that the distance travel by the raw material needs to be reduced and it is done by applying systematic layout planning. The relative importance of having one department near another is displayed in relationship chart. "Robert Muther" developed the REL chart. The relationship diagrams recognize the need for exploring relationship rather than calculating exact flow and cost. Here we are using similar technique in which three different colours are used to indicate the closeness desired between machines and other resources. Since, it is small scale company we are listing all resources. After making activity relationship chart the proposed layout is made.

Different machines with other resources are listed below.

1. Stablizer-1
2. Stablizer-2
3. Tool rack-1
4. Tool rack-2
5. CNC-1
6. CNC-2
7. VMC
8. Drilling
9. Cutter
10. Storage area-1
11. Storage area-2(raw material)
12. Storage area -3(scrap)
13. Static balancing (inspection)
14. Desk
15. Compressor -1
16. Compressor-2
17. Compressor-3(useless)
18. Hacksaw (useless)
19. Packaging area

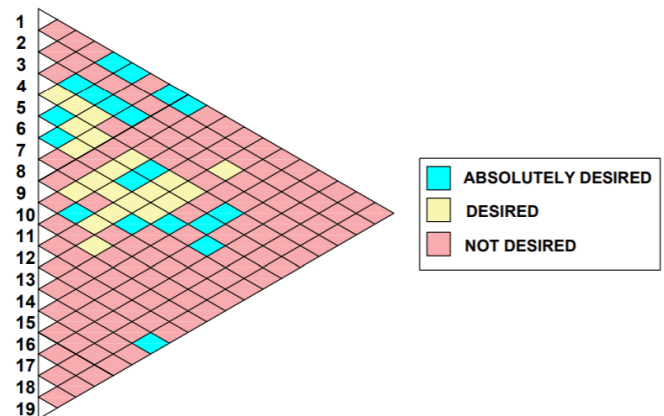


Fig.No.4: Activity relationship chart

VI. ANALYSIS OF PROPOSED LAYOUT

The new layout is based on activity relationship chart, where by altering position of different machines and resources we are reducing total travel distance by material throughout workplace also we are proposing the door between two sections. The proposed layout is shown in Fig.No.5 while Table.No.2 shows the total cost and travel distance of proposed layout.

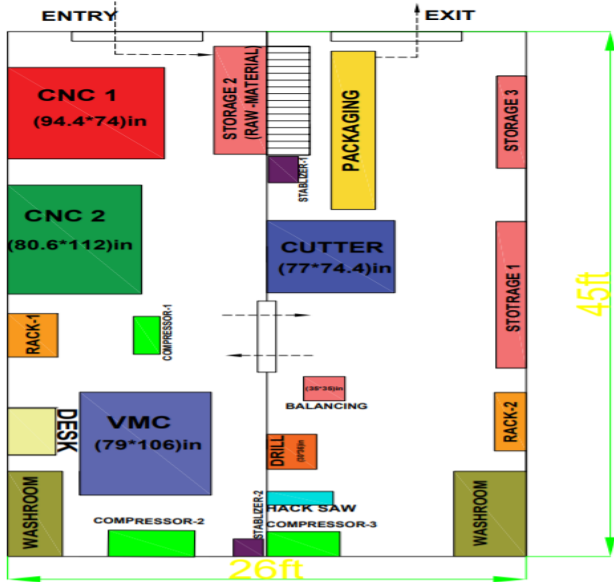


Fig.No.5: Proposed layout

TABLE II. DISTANCE AND COST INVOLVED WITH PROPOSED LAYOUT

From	To	Distance (ft)	Unit Cost (rs)
raw material	cnc 1	2.88	21.1104
cnc 1	cnc 2	2.667	19.54
cnc 2	vmc	10.08	73.88
vmc	cnc 1	22.08	161.84
cnc 1	cnc2	2.667	19.54
cnc 2	static balancing	17.22	126.22
drilling	packaging	4.187	30.69
packaging	dispatch	31.86	233.53
Total		93.641	686.3504

VII. RESULT

After analyzing the existing layout the overall distance and cost of handling the material is 216.67 ft and Rs.1587.68 while it is reduced to 93.641 ft and Rs. 686.3504 for the proposed layout. The total handling cost can be reduced by 56.8% according to the layout which is proposed. It is due to reduction in total distance travel by the material throughout work place.

VIII. CONCLUSION

This research paper has provided good exposure about plant layout by using systematic layout technique in consideration with travel distance and cost to improve existing layout. The problem with existing layout is large distance between some machines which leads to higher cost. In proposed layout we are using activity relationship chart to alter the position of machines and other resources. Therefore the overall efficiency of company is increased thereby reducing the overall cost and the spacing is increased in a company which can be utilize for different purpose.

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